CMBR Isotropy and Anisotropy in Stoney Scale Black Hole Cosmology

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Abstract: If one is willing to consider the current cosmic microwave back ground temperature as a quantum gravitational effect of the evolving primordial cosmic black hole general theory of relativity and quantum mechanics can be combined into a 'scale independent' true unified model of quantum gravity. It can be suggested that, universe may or may not be a black hole, Hubble volume can be considered as a growing and light speed rotating black hole at 99% confidence level. With this proposal galactic rotational curves, cosmic dynamic stability can be understood. By considering the 'Stoney mass' as the initial mass of the baby Hubble volume, past and current physical and thermal parameters of the cosmic black hole can be understood. Isotropy and anisotropy of CMB can be understood. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion or acceleration. To understand the ground reality of current cosmic rate of expansion, sensitivity and accuracy of current methods of estimating the magnitudes of current CMBR temperature and current Hubble constant must be improved and alternative methods must be developed. If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of galactic hydrogen atom, then considering redshift as an index of 'whole galaxy' receding may not be reasonable. During cosmic evolution, at any time in the past , in hydrogen atom emitted photon energy was always inversely proportional to the CMBR temperature. Thus past light emitted from older galaxy's excited hydrogen atom will show redshift with reference to the current laboratory data. As cosmic time passes, in future, the absolute rate of cosmic expansion can be understood by observing the rate of increase in the magnitude of photon energy emitted from laboratory hydrogen atom. Past cosmic high temperature may be the root cause of observed super novae dimming. Like ILLUSTRIS, with advanced mathematics and computer simulation technology this model can be virtually developed for further study and analysis.

Keywords: Standard cosmology, Stoney mass, Black Hole Cosmology, Cosmic growth index, Cosmic redshift, Galaxy rotation curves, Cosmic age, CMB Isotropy and Anisotropy, Final Unification.

1. INTRODUCTION

History of cosmology is very interesting. At first in 1916 Einstein proposed an intellectual but unsuccessful static model of cosmology with the famous 'lambda term' and science community forced him to abandon the term [1]. Later in 1920s Friedmann proposed an expanding model of cosmology. As a reviewer Einstein rejected it and was recognized [2] only after Hubble's work on the galactic redshift [3]. Without reaching any other part of the universe, Friedmann boldly proposed that universe looks the same from any part of the universe! In this regard in 1988 S.W. Hawking suggested that, there is no scientific evidence to Friedmann's second assumption and it is being believed only on modesty [4]. Very unfortunate thing is that, so far science and technology could not provide a single clue in support of this assumption. If so, one can certainly doubt the output physics and consequences of Friedmann cosmology. In 1948 Fred Hoyle proposed 'steady state cosmology' and was found to be insightful [5]. In 1948 Gamow proposed hot big bang model of expanding cosmology and was not recognized by the science community[6]. In 1964 unexpectedly hot big bang model got a great evidence [7]. In 2000, cosmologists again unexpectedly proposed accelerating model of cosmology with distant super novae dimming [8,9,10] against a normally expected 'decelerating model of hot big bang'. Most surprising thing is that so far no telescope or particle accelerator provided evidence to the indirectly confirmed 'dark energy' of the accelerating model of the universe. Another interesting thing is that, the abandoned lambda term has been re-considered by the science community to understand the existence of dark energy. In this long journey the very interesting thing is that, the subject of cosmology [11,12] was largely influenced by Hubble's interpretations on galactic redshift [13] and Inflation concepts [14]. Since 1980s 'cosmic inflation' is so widely accepted that it is often taken as an established fact. The idea is that the geometry and uniformity of the cosmos were established during an intense early growth spurt. But very shocking news is that, some of the creators of the inflation theory, like Paul J. Steinhardt, are having second thoughts. As the original theory has been developed, cracks have appeared in its logical foundations. Various proposals are being circulated for ways to fix or replace it. Quantum cosmology is a field attempting to study the effect of quantum mechanics on the formation of the universe, or its early evolution, especially just after the Big Bang. Despite many attempts, the field remains a rather speculative branch of quantum gravity [15-19]. Even though the observed galactic rotational curves can be explained by the Modified Newtonian Dynamics [20-24] with the cosmological acceleration term (cH_0), standard cosmology is not clear about the implementation of (cH_0).

Here the authors would like to stress the fact that, without measuring and confirming the 'actual' galaxy receding, it may not be reasonable to confirm the Hubble's redshift interpretation, the current cosmic acceleration and the existence of dark energy. Even though standard cosmology indirectly confirmed the existence of dark energy and dark matter, so far no ground based laboratory confirmed their individual existence. If theoretical predictions are not in line with the observations, then either observations has to be interpreted in a different manner or theory has to be modified as per the observations. In this context, quantum gravity can be a considered as a key tool. Although a quantum theory of gravity or quantum cosmology is needed in order to merge general relativity with the principles of quantum mechanics, difficulties arise when one attempts to apply the usual prescriptions of quantum field theory to the force of gravity. Out of all currently, there is still no complete and consistent quantum theory of gravity, and the candidate models still need to overcome major formal and conceptual problems. Even though there are a number of other approaches to quantum gravity, as of now, there is no way to put quantum gravity predictions to experimental tests. Even though it is a must, so far, nobody is clear about 'quantum gravity'. Clearly speaking , whether to see quantum effects in a gravity field or to see a continuum in quantum mechanics or to see the combined effects of gravity and quantum mechanics – is not yet clear. Anyhow combining quantum mechanics and general theory of relativity is a must and needs conceptual fine tuning. It can be achieved in the following way also.

1) To consider the cosmic microwave back ground temperature as a quantum gravitational effect.
2) To consider the CMBR temperature as the characteristic temperature of the evolving primordial cosmic black hole.
3) To consider the primordial cosmic black hole as an evolving and light speed rotating black hole with angular velocity identical with the cosmological Hubble constant.
4) As suggested by the hot big bang model, to consider the current black hole universe as decelerating. Modern cosmologists believe that the rate of the change of the Hubble constant describes how fast/slow the Hubble constant changes over time and this rate does not tell if the Universe is currently expanding. This logic seems to be misleading. In authors opinion, if magnitude of past Hubble's constant was higher than the current magnitude then magnitude of past (c/H_t) will be smaller than the current Hubble length (c/H_0). If so rate of the decrease of the Hubble constant can be considered as a true index of rate of increase in Hubble length and thus with reference to Hubble length, rate of the decrease of the Hubble constant can be considered as a true index of cosmic rate of expansion. Proceeding further - in future, certainly with reference to current Hubble's constant, $d(c/H_0)/dt$ gives the true cosmic rate of expansion. Same logic can be applied to cosmic back ground temperature also. Clearly speaking $d(T_0)/dt$ gives the true cosmic rate of expansion. To understand the ground reality, sensitivity and accuracy of current methods of estimating the magnitudes of $(H_0 \text{ and } T_0)$ must be improved.

1.1 Basic short comings of modern cosmology

Proceeding further, the basic shortcomings of modern cosmology can be expressed as follows. For more information see the authors published self references.

1) So far no ground based experiment directly simulated and confirmed the Hubble's redshift based increase in photon wavelength/loss in photon energy and so far no ground based experiment directly confirmed the actual galaxy receding and galaxy acceleration.
2) So far no ground based experiment directly confirmed the existence of dark energy and dark matter.
3) So far no ground based experiment directly confirmed the basic physically observable characteristics of dark matter or dark energy.
1) So far no ground based experiment directly confirmed the current magnitudes of dark matter content /dark energy content /observable cosmic matter content. Thus so far no body quantified the distance cosmic back ground.
4) If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of hydrogen atom, then considering redshift as an index of 'whole galaxy' receding may not be reasonable. Merely by estimating galaxy distance and without measuring galaxy receding speed, one cannot

verify its receding speed or acceleration. (Clearly speaking: two mistakes are being possible here. i) Assumed galaxy receding speed is not being measured and not being confirmed. ii) Without measuring and confirming the galaxy receding speed, how can one say and confirm that it (galaxy) is accelerating).

5) Modern cosmologists believe that the rate of the change of the Hubble constant describes how fast/slow the Hubble constant changes over time and this rate does not tell if the Universe is currently expanding. This logic seems to be misleading. In authors opinion, if magnitude of past Hubble's constant was higher than the current magnitude then magnitude of past (c/H_t) will be smaller than the current Hubble length (c/H_0). If so rate of the decrease of the Hubble constant can be considered as a true index of rate of increase in Hubble length and thus with reference to Hubble length, rate of the decrease of the Hubble constant can be considered as a true index of cosmic rate of expansion. Proceeding further - in future, certainly with reference to current Hubble's constant, $d(c/H_0)/dt$ gives true cosmic rate of expansion. Same logic can be applied to CMBR temperature.
6) No direct observational evidence to Friedmann's second assumption [4]. We believe it only on the grounds of modesty. Really if there was a 'big bang' in the past, with reference to formation of the big bang as predicted by general theory of relativity and with reference to the cosmic expansion that takes place simultaneously in all directions at a uniform rate at that time about the point of big bang - 'point' of big bang can be considered as the centre or characteristic reference point of cosmic expansion in all directions. In this case, saying that there is no preferred direction in the expanding universe - may not be correct.
7) No theoretical base in considering the Hubble's constant merely as the cosmic expansion parameter. With coefficient of unity, if one is willing to consider (c/H_0) as a characteristic length, then based on elementary dimensional analysis it is very simple to show that, dimensions of H_t are rad/sec and thus with a coefficient of unity and with reference to the characteristic light speed, H_t can be considered as cosmic angular velocity. Note that, in any case if length coefficient is less than unity or greater than unity, 'Hubble length' may lose its physical identity.
8) 'Rate of decrease in current 'Hubble's constant' can be considered as a measure of current cosmic 'rate of expansion'. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion or acceleration. To understand the ground reality, sensitivity and accuracy of current methods of estimating the magnitude of H_0 must be improved.
9) When Friedmann's cosmology was taking its final shape, black hole physics was in its beginning stage. Recent observations confirm the light speed rotation of black holes. So far no theoretical proof is available for cosmic non-rotation. So far no experimental or observational evidence is available for super luminal rotation speed of any celestial object. By considering 'black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' with Hubble constant as angular velocity, throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'mass density'. If so it is possible to suggest that, there is no theoretical base in Friedmann's 'critical density' concept and the 'matter density' classification scheme.
10) If one is willing to accept 'Planck mass' as the characteristic beginning 'mass scale' of the expanding universe, by substituting the geometric mean mass of current Hubble mass and Planck mass in the famous Hawking's black hole temperature formula automatically the observed 2.725 K can be fitted very accurately. One should not ignore this coincidence. Note that, drop in current 'cosmic temperature' can be considered as a measure of the current cosmic expansion and 'rate of decrease in current cosmic temperature' can be considered as a measure of the current cosmic 'rate of expansion'. But if rate of decrease in temperature is very small and is beyond the scope

of current experimental verification, then the two possible states are: a) current cosmic temperature is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' thermal expansion and there is no 'observable' cosmic expansion. If observed CMBR temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable.

11) So far the observed galactic rotational curves could not be explained by standard cosmology with the cosmological acceleration constant.
12) Mach's principle is not being implemented in standard cosmology. To understand the beauty of Mach's principle, distance cosmic back ground must be quantified.
13) No comparative and relational study in between Friedmann cosmology, Mach's principle [25] and microscopic physical phenomena.
14) So far standard model of cosmology could not disprove the black hole model of cosmology [26-37].

1.2 Need and Applications Black Hole Cosmology

Based on these facts, parallel to the currently believed standard cosmology authors proposed a theoretical model of evolving and light speed rotating black hole cosmology. Advantages of the proposed model can be expressed as follows. 1) Un-quantified big bang physical parameters can be replaced with the quantified Planck scale and can be easily be implemented. 2) Distance cosmic back ground can be quantified in terms of cosmic size, volume and mass. 3) Based on the quantification of distance cosmic back ground, observed current thermal energy density and matter density can be fitted and the corresponding past/future data can be extrapolated. Not only that, observed temperature fluctuations the CMB anisotropy can also be understood. 4) Observed galactic redshift can be re-interpreted as an index of cosmological thermodynamic atomic light emission mechanism. With reference to the decreasing CMBR temperature and considering the current and future photon energy emitted from ground based laboratory hydrogen atom - the actual or true cosmic rate of expansion can be understood experimentally. 5) Based on the quantification of distance cosmic back ground, cosmology and microscopic physics can be studied in a unified manner and the true current cosmic rate of expansion can be understood. 6) Along with the mass of galaxy, current mass of the black hole universe play a vital role in understanding the galaxy rotation curve. With reference to the MOND result rotational speed of a star in any galaxy can be represented as $\approx \sqrt[4]{GM(cH_0)}$. where M is the mass of galaxy. Considering the galactic revolving speed v about the center of the cosmic black hole (that rotates at light speed)), magnitude of (cH_0) can be assumed to vary as $(v/c)(cH_0) \cong (vH_0)$. Thus rotational speed of a star in any galaxy can be represented as $\cong \sqrt[4]{GM(vH_0)}$.

Authors published their concepts on black hole cosmology in many online journals [38-40]. In this paper by highlighting the basic short comings of modern cosmology an attempt is made to review the model of black hole cosmology in terms of cosmic redshift, CMBR redshift, cosmic growth index, cosmic growth rate and cosmic age. According to standard cosmology, if T_t is the temperature of the CMB and z is the observed redshift, then $T_t \cong (1+z)2.725$ K where $(1+z)$ is known as the universal scale factor. Extending this concept, in this paper an attempt is made to re-interpret and re-understand the observed cosmic redshift in the following way. 1) If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of hydrogen atom, then considering redshift as an index of 'whole galaxy' receding may not be reasonable. 2) If light is coming from the atoms of the gigantic galaxy, then instead of wavelength difference, in terms of 'quantum of energy' redshift can also be interpreted as an index of the galactic cosmological atomic 'light emission mechanism' and emitted quantum of energy is inversely proportional to the CMB temperature. If so aged and distant super novae dimming effect can also be understood as a result of high CBR temperature. 3) According to the modern cosmological approach, bound systems like 'atoms' which are found to be the major constituents of galactic matter - will not change with cosmic expansion/acceleration. As per the present observational data this may be true. But it might be the result of ending stage of cosmic expansion. As the issue is directly related with unification it requires lot of research in basic physics to confirm. In this regard, without considering and without analysing the past data, one can not come to a conclusion. If one is willing to think in this direction observed galactic redshift data can be considered for this type of new analysis. In 1947 Hubble himself stated that: "We may predict with confidence that the 200 inch will tell us whether the red shifts must be accepted as evidence of a rapidly expanding universe, or attributed to some new principle in nature. Whatever may be the answer, the result may be welcomed as another major contribution to the exploration of the universe."

Friedmann made two simple assumptions about the universe. They can be stated in the following way.

1. When viewed at large enough scales, universe appears the same in every direction.
2. When viewed at large enough scales, universe appears the same from every location.

In this regard Hawking says : "There is no scientific evidence for the Friedmann's second assumption. We believe it only on grounds of modesty: it would be most remarkable if the universe looked the same in every direction around us, but not around other points in the universe". This is one key point to be noted here. The term 'critical density' is the back bone of modern cosmology. At any time in the past, it is generally expressed in the following way.

$$(\rho_c)_t \cong \frac{3H_t^2}{8\pi G} \tag{1}$$

Its current expression is as follows.

$$(\rho_c)_0 \cong \frac{3H_0^2}{8\pi G} \tag{2}$$

According to standard Friedmann cosmology,

1. If matter density is greater than the critical density, universe will have a positive curvature.
2. If matter density equals the critical density, universe will be flat.
3. If matter density is less than the critical density, universe will have a negative curvature.

But by considering 'black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'volume density'. If mass of the black hole universe is M_t, (c/H_t) is the radius of the black hole universe that rotates at light speed with angular velocity H_t, at any time in the past,

$$\frac{2GM_t}{c^2} \cong \frac{c}{H_t} \text{ and } M_t \cong \frac{c^3}{2GH_t}. \tag{3}$$

At any time in the past, if one is willing to consider the Hubble length (c/H_t) as the radius of growing cosmic black hole, then angular velocity being H_t, magnitude of the Schwarzschild radius of the light speed rotating cosmic black hole and the magnitude of Hubble length can be the same.

$$(\rho_v)_t \cong (M_t)\left[\frac{4\pi}{3}\left(\frac{c}{H_t}\right)^3\right]^{-1} \cong \left(\frac{c^3}{2GH_t}\right)\left[\frac{3}{4\pi}\left(\frac{H_t}{c}\right)^3\right] \cong \frac{3H_t^2}{8\pi G} \tag{4}$$

At present,

$$(\rho_v)_0 \cong (M_0)\left[\frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3\right]^{-1} \cong \left(\frac{c^3}{2GH_0}\right)\left[\frac{3}{4\pi}\left(\frac{H_0}{c}\right)^3\right] \cong \frac{3H_0^2}{8\pi G} \tag{5}$$

Clearly speaking, when the currently believed 'critical density' itself represents the mass density of a light speed rotating black hole universe and as there is no observational or experimental evidence to Friedmann's second assumption, the density classification scheme of Friedmann cosmology must be reviewed at fundamental level.

If 'growth' or 'expansion' is a characteristic feature of the evolving black hole universe, then as time passes, for the growing cosmic black hole (c/H_t) increases (c/H_0). As a sequel, density of the growing cosmic hole decreases from $\frac{3H_t^2}{8\pi G}$ to $\frac{3H_0^2}{8\pi G}$. To interrelate (c/H_t) and (c/H_0), or to interrelate H_t and H_0, and to understand the outline picture, authors assume that, forever rotating at light speed, high temperature and high angular velocity small sized primordial cosmic black hole of mass close to the Planck scale gradually transforms into a low temperature and low angular velocity large sized massive primordial cosmic black hole. At any given cosmic time, for the primordial growing black hole universe, its 'Schwarzschild radius' can be considered as its characteristic possible minimum radius and 'constant light speed rotation' will give the maximum possible stability from collapsing.

2. POSSIBLE ASSUMPTIONS AND POSSIBLE EXPLANATION

Possible assumptions in unified cosmic physics can be expressed in the following way.

Assumption-1: With reference to the elementary charge and with mass similar to the Planck mass, a new mass unit can be constructed in the following way. It can be called as the Stoney mass.

$$\left(M_S\right)^{\pm} \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \cong 1.859272\times10^{-9}\ \text{Kg} \cong 1.042975\times10^{18}\ \text{GeV/c}^2 \tag{6}$$

Explanation: It is well known that e, c, G play a vital role in fundamental physics. With these 3 constants space-time curvature concepts at a charged particle surface can be studied. It was first introduced by the physicist George Johnstone Stoney [41]. He is most famous for introducing the term 'electron' as the 'fundamental unit quantity of electricity'. With this mass unit in unification program with a suitable proportionality it may be possible to represent the characteristic mass of elementary charge. Note that the basic concept of unification is to understand the origin of 'mass' of any particle. Mass is the basic property in 'gravitation' and charge is the basic property in 'atomicity'. So far no model established a cohesive relation in between 'electric charge' and 'mass' of any 'elementary particle' or 'cosmic dust'. From physics point of view, the fundamental questions to be answered are: 1) Without charge, is there any independent existence to "mass"? 2) Without mass, is there any independent existence to "charge"? From unification point of the fundamental questions to be answered are: 1) What is a graviton? How elementary constants play role in generating a graviton? [42-45] From cosmology point of view the fundamental questions to be answered are: 1) What is 'cosmic dust'? 2) Without charge, is there any independent existence to "cosmic dust"? From astrophysics point of view the fundamental questions to be answered are: 1) Without charge, is there any independent existence to 'mass' of any star? 2) Is black hole – a neutral body or electrically a neutralized body? To understand these questions the authors made an attempt to construct the above unified mass unit. It is having a long history. It can be considered as the seed of galactic matter or galactic central black hole. It can also be considered as the seed of any cosmic structure. If 2 such oppositely charged particles annihilates, a large amount of energy can be released. If so under certain extreme conditions at the vicinity of massive stars or black holes, a very high energy radiation can be seen to be emitted by the pair annihilation of M_S. With this mass unit, proton-electron mass ratio and proton and electron rest masses can be fitted. Thus with reference to the elementary charge and electron & proton rest masses, magnitude of the gravitational constant can be fitted. After going through Appendix-1, see Appendix-2 for its best unified applications.

Assumption-2: At any time, H_t being the angular velocity, universe can be considered as a growing and light speed rotating primordial black hole. Thus at any given cosmic time,

$$R_t \cong \frac{2GM_t}{c^2} \cong \frac{c}{H_t} \quad \text{and} \quad M_t \cong \frac{c^3}{2GH_t} \tag{7}$$

If $H_0 \cong 70$ km/sec/Mpc, $M_0 \cong 8.8984\times10^{52}$ kg and $R_0 \cong 1.32153\times10^{26}$ m.

when $M_t \to M_S$,

$$\left.\begin{aligned} R_S &\cong \frac{2GM_S}{c^2} \cong 2.7613\times10^{-36}\ \text{m and} \\ H_S &\cong \frac{c}{R_S} \cong \frac{c^3}{2GM_S} \cong 1.0857\times10^{44}\ \text{rad/sec} \end{aligned}\right\} \tag{8}$$

can be considered as the characteristic initial physical measurements of the universe. Here the subscript S refers to the initial conditions of the universe and can be called as the Stoney scale. Similarly

$$R_0 \cong \frac{2GM_0}{c^2} \cong \frac{c}{H_0},\quad M_0 \cong \frac{c^3}{2GH_0} \text{ and } H_0 \cong \frac{c^3}{2GM_0} \tag{9}$$

can be considered as the characteristic current physical measurements of the universe.

Assumption-3: During cosmic evolution, at any time the past , in hydrogen atom emitted photon energy was always inversely proportional to the cosmic temperature. Thus past light emitted from older galaxy's hydrogen atom will show redshift with reference to the current laboratory data. There will be no change in the energy of the emitted photon during its journey from the distant galaxy to the observer.

$$\frac{E_0}{E_t} \cong \frac{\lambda_t}{\lambda_0} \cong \frac{T_t}{T_0} \cong \left(z_0+1\right) \tag{10}$$

Here, E_t is the energy of emitted photon from the galactic hydrogen atom and E_0 is the corresponding energy in the laboratory. λ_t is the wave length of emitted and received photon from the galactic hydrogen atom and λ_0 is the corresponding wave length in the laboratory. T_t is the cosmic temperature at the time when the photon was emitted and T_0 is the current cosmic temperature and z_0 is the current redshift.

If one is willing to consider this proposal, in hydrogen atom emitted photon energy can be understood as follows. As the cosmic time increases cosmic angular velocity and hence cosmic temperature both decrease. As a result, during cosmic evolution, in hydrogen atom, binding energy increases in between proton and electron. As cosmic temperature decreases, it requires more excitation energy to break the bond between electron and the proton. In this way, during cosmic evolution, whenever it is excited, hydrogen atom emits photons with increased quantum of energy. Thus past light quanta emitted from old galaxy's excited hydrogen atom will have less energy and show a red shift with reference to the current laboratory magnitude. During journey light quanta will not lose energy and there will be no change in light wavelength. Galactic photon energy in hydrogen atom when it was emitted can be estimated as follows.

$$\left.\begin{array}{l} E_t \cong \dfrac{hc}{\lambda_t} \cong \left(\dfrac{T_0}{T_t}\right)\left(\dfrac{hc}{\lambda_0}\right) \cong \left(\dfrac{T_0}{T_t}\right)E_0 \\ z_0 \cong \dfrac{\lambda_t - \lambda_0}{\lambda_0} \cong \dfrac{E_0 - E_t}{E_t} \cong \dfrac{T_t - T_0}{T_0} \end{array}\right\} \tag{11}$$

z_0 can be called as the current red shift. In literature many definitions are available for the cosmic redshift [46]. In subsection 2.4 an attempt is made to understand the cosmological thermodynamic light emission mechanism in hydrogen atom in a unified approach.

From laboratory point of view, above concept can be understood in the following way. After some time in future,

$$z_f \cong \frac{E_f - E_0}{E_0} \cong \frac{E_f}{E_0} - 1 \tag{12}$$

Here, E_f is the energy of photon emitted from laboratory hydrogen atom after some time in future. E_0 is the energy of current photon emitted from laboratory hydrogen atom. z_f is the redshift of laboratory hydrogen atom after some time in future. From now onwards, as time passes, in future - $\left[d\left(z_f\right)/dt\right]$ can be considered as an index of the absolute rate of cosmic expansion. As cosmic time passes, within the scope of experimental accuracy of laboratory hydrogen atom's redshift, if magnitude of $\left[d\left(z_f\right)/dt\right]$ is gradually increasing, it is an indication of cosmic acceleration. If magnitude of $\left[d\left(z_f\right)/dt\right]$ is practically constant, it is an indication of uniform rate of cosmic expansion. If magnitude of $\left[d\left(z_f\right)/dt\right]$ is gradually decreasing, it is an indication of cosmic deceleration. If magnitude of $\left[d\left(z_f\right)/dt\right]$ is zero, it is an indication of cosmic halt. In support of this idea, rate of decrease in 'current Hubble's constant' and rate of decrease in 'current CMBR temperature' can be considered as a true measure of current cosmic 'rate of expansion'.

Assumption-4: At any given time, ratio of volume energy density and thermal energy density can be called as the cosmic growth index and can be expressed as follows.

$$\frac{3H_t^2c^2}{8\pi GaT_t^4} \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^2 \cong \text{Cosmic Growth index} \tag{13}$$

Thus at the Stoney scale,

$$\frac{3H_S^2c^2}{8\pi GaT_S^4} \cong \left[1+\ln\left(\frac{M_S}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_S}\right)\right]^2 \cong 1 \tag{14}$$

Assumption-5: At any given time, cosmic black hole's growth rate can be expressed as $g_t \cong \left(\dfrac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1} c$. With this idea and by considering the average growth rate cosmic age can be estimated.

$$g_t \cong \text{Cosmic growth rate} \cong \frac{c}{\text{cosmic growth index}}$$
$$\cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1} c \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2} c \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} c \tag{15}$$

At the Stoney scale,

$$g_S \cong \left(\frac{3H_S^2c^2}{8\pi GaT_S^4}\right)^{-1} c \cong \left[1+\ln\left(\frac{M_S}{M_S}\right)\right]^{-2} c \cong \left[1+\ln\left(\frac{H_S}{H_S}\right)\right]^{-2} c \cong c$$

With reference to (H_S, H_0), current Hubble length is growing at a rate of 14.66 km/sec. As a result, at present, within the current Hubble length galaxy distance from the cosmic center increases as $\left(\frac{r_g}{R_0}\right)14.66 \cong \left(\frac{r_g H_0}{c}\right)14.66$ km/sec where $r_g \le \left(R_0 \cong \frac{c}{H_0}\right)$ and r_G is the distance between galaxy and the cosmic center and R_0 is the current Hubble length. Thus $\left(\frac{r_g H_0}{c}\right)14.66$ km/sec can be called as the current receding speed of any galaxy. As the current Hubble length is increasing, again the magnitude of future Hubble constant decreases, and hence the growth rate of future Hubble length falls down to 14.66 km/sec. In this way, theoretically the proposed current cosmic deceleration can be understood.

Assumption-6: Anisotropy of cosmic back ground temperature or fluctuations in cosmic temperature are inversely proportional to the growth rate.

$$\frac{\delta T}{T_t} \cong \frac{T_t}{\text{cosmic growth index}} \cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1} T_t$$
$$\cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2} T_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} T_t \tag{16}$$

2.1 Possible Explanation For The Proposed Assumptions

To have some clarity and to have some quantitative measurements and fittings of initial and current states of the black hole universe - instead of considering 'star - black hole explosions' and 'higher dimensions', the authors of this paper focused their attention only on the old and famous Mach's principle, 'Hubble volume' and 'primordial evolving black holes'. Some cosmologists use the term 'Hubble volume' to refer to the volume of the observable universe. There is no perfect fundamental theory that defines the lower and upper limits of a massive black hole. Most of the theoretical models assume a lower mass limit close to the 'Planck mass'. Astronomers believe that black holes that are as large as a billion solar masses can be found at the centre of most of the galaxies. Here the fundamental questions to be answered are: If the galactic central black hole mass is 10 billion solar masses and density is less than 1 kg/m^3 - with such a small density and large mass, without collapsing - how it is able to hold a gigantic galaxy? What force makes the black hole stable? Recent observations confirm that, instead of collapsing, galactic central black holes are growing faster and spinning with light speed. Even though mass is too high and density is too low, light speed rotation certainly helps in maintaining black hole's stability from collapsing with maximum possible outward radial force of the magnitude close to $\left(c^4/G\right)$. Based on these points the authors propose the following picture of Black hole cosmology. Here 3 important points can be stated as follows.

1. In theoretical physics, particularly in discussions of gravitation theories, Mach's principle is the name given by Einstein to an interesting hypothesis often credited to the physicist and philosopher Ernst Mach. The idea is that the local motion of a rotating reference frame is determined by the large scale distribution of matter. With reference to the Mach's principle and the Hubble volume, at any cosmic time, if 'Hubble mass' is the product of cosmic 'critical density' and the 'Hubble volume', then it can be suggested that, i) Each and every point in the free space is influenced by the Hubble mass, ii) Hubble volume and Hubble mass play a vital role in understanding the properties of electromagnetic and nuclear interactions and iii) Hubble volume and Hubble mass play a key role in understanding the geometry of the universe. With reference to the famous Mach's principle, 'Hubble volume' and 'Hubble mass' both can be con-

sidered as quantitative measurements of the ‘distance cosmic back ground’. As a first attempt, in this paper authors proposed a semi empirical relation that connects the CMBR energy density, Hubble’s constant and $\sqrt{e^2/4\pi\varepsilon_0 G}$.

2. Starting from an electron to any gigantic galaxy, rotation is a common phenomenon in atomic experiments and astronomical observations. From Newton’s laws of motion and based on the Mach's principle, sitting inside a closed universe, one cannot comment whether the universe is rotating or not. We have to search for alternative means for confirming the cosmic rotation. Recent findings from the University of Michigan [47] suggest that the shape of the Big Bang might be more complicated than previously thought, and that the early universe spun on an axis. A left-handed and right-handed imprint on the sky as reportedly revealed by galaxy rotation would imply the universe was rotating from the very beginning and retained an overwhelmingly strong angular momentum. An anonymous referee who reviewed the paper for Physics Letters said, “In the paper the author claims that there is a preferred handedness of spiral galaxies indicating a preferred direction in the universe. Such a claim, if proven true, would have a profound impact on cosmology and would very likely result in a “Nobel prize”. The consequences of a spinning universe [48-60] seem to be profound and natural. Not only that, with ‘constant rotation speed’ ‘cosmic collapse’ can be prevented and can be considered as an alternative to the famous ‘repulsive gravity’ concept. If so, at any time to have maximum possible stability from collapsing ‘constant light speed rotation’ can be considered as a constructive and workable concept.
3. Recent observations confirm black hole’s light speed rotation. In 2013 February, using NASA's newly launched NuStar telescope and the European Space Agency's workhorse XMM-Newton, an international team observed high-energy X-rays released by a super massive black hole in the middle of a nearby galaxy. They calculated its spin at close to the speed of light: 670 million mph [61,62].Please note that, for any black hole even though its mass is too high and density is too low, light speed rotation certainly helps in maintaining its stability from collapsing with maximum possible outward radial force of magnitude $\left(c^4/G\right)$. At the beginning of comic evolution if rotation speed was zero and there was no big bang - definitely it will cast a doubt on the stability, existence and angular velocity of the assumed initial primordial cosmic baby black hole. Hence at the beginning also, to guess or define the angular velocity and to have maximum possible stability it is better to assume light speed rotation for the cosmic baby black hole. At present if rate of cosmic expansion is very slow, then rate of decrease in angular velocity will be very small and practically can be considered as zero. Along with (practically) constant angular velocity, at present if constant light speed rotation is assumed to be maintained then cosmic stability will be maximum and rate of change in cosmic size will be practically zero and hence this idea helps us to believe in present Hubble length along with the observed ordered galactic structures and uniform thermal energy density.

2.2 To Reinterpret The Hubble’s Constant

With a simple derivation it is possible to show that, Hubble’s constant H_t represents the cosmological angular velocity. Authors presented this derivation in their published papers. Basic idea of this derivation is to express the angular velocity of any rotating celestial body in terms of its mass, radius, mass density and surface escape velocity. Assume that, a planet of mass M and radius R rotates with angular velocity ω_e and linear velocity v_e in such a way that, free or loosely bound particle of mass m lying on its equator gains a kinetic energy equal to potential energy as,

$$\frac{1}{2}mv_e^2 = \frac{GMm}{R} \tag{17}$$

$$R\omega_e = v_e = \sqrt{\frac{2GM}{R}} \text{ and } \omega_e = \frac{v_e}{R} = \sqrt{\frac{2GM}{R^3}} \tag{18}$$

i.e Linear velocity of planet’s rotation is equal to free particle’s escape velocity. Without any external power or energy, test particle gains escape velocity by virtue of planet’s rotation. Note that if Earth completes one rotation in one hour then free particles lying on the equator will get escape velocity. Now writing $M = \frac{4\pi}{3}R^3\rho_e$,

$$\omega_e = \frac{v_e}{R} = \sqrt{\frac{8\pi G\rho_e}{3}} \text{ Or } \omega_e^2 = \frac{8\pi G\rho_e}{3} \tag{19}$$

$$\text{Density, } \rho_e = \frac{3\omega_e^2}{8\pi G} \tag{20}$$

In real time, this obtained density may or may not be equal to the actual density. But the ratio $\frac{8\pi G\rho_{real}}{3\omega_{real}^2}$ may have some physical significance. The most important point to be noted here, is that, as far as dimensions and units are considered, from equation (19), it is very clear that, proportionality constant being $\frac{3}{8\pi G}$,

$$\text{density} \propto (\text{angular velocity})^2 \tag{21}$$

Equation (20) is similar to "flat model concept" of cosmic "critical density"

$$\rho_c = \frac{3H_t^2}{8\pi G} \tag{22}$$

Comparing equations (20) and (22) dimensionally and conceptually, i.e.

$$\rho_e = \frac{3\omega_e^2}{8\pi G} \text{ with } \rho_{\mathrm{c}} = \frac{3H_{\mathrm{t}}^2}{8\pi \mathrm{G}} \tag{23}$$

$$H_t^2 \to \omega_{\mathrm{e}}^2 \text{ and } H_t \to \omega_e \tag{24}$$

It is very clear that, dimensions of 'Hubble's constant' must be 'radian/second'. In any physical system under study, for any one 'simple physical parameter' there will not be two different units and there will not be two different physical meanings. This is a simple clue and brings 'cosmic rotation' into picture. This is possible in a closed universe only. Cosmic models that depend on this "critical density" may consider 'angular velocity of the universe' in the place of 'Hubble's constant'. In the sense, with a great confidence 'cosmic rotation' can be included in the existing models of cosmology. Then the term 'critical density' appears to be the 'volume density' of the closed and expanding universe. Thinking in this way, **c**onsidering **'**black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'volume density'. Thus based on the Mach's principle, 'distance cosmic back ground' can be quantified in terms of 'Hubble volume' and 'Hubble mass'.

2.3 To Reinterpret The Hubble's Law

Based on the assumptions it is possible to say that, during cosmic evolution, as the universe is growing and rotating, at any time, any galaxy will have revolution speed as well as receding speed simultaneously and both can be expressed in the following way.

$$\left(V_g\right)_{revolution} \cong \left(\frac{r_g}{R_t}\right) c \cong r_g H_t \quad \text{where} \quad r_g \le \left(R_t \cong \frac{c}{H_t}\right) \tag{25}$$

r_g is the distance between galaxy and the cosmic center and R_t is the cosmic radius at time t.

$$\begin{aligned}\left(V_g\right)_{receding} &\cong \left(\frac{r_g}{R_t}\right) g_t \cong \left(\frac{r_g}{R_t}\right)\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} c \\ &\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} r_g H_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} \left(V_g\right)_{revolution}\end{aligned} \tag{26}$$

$$\frac{\left(V_g\right)_{revolution}}{\left(V_g\right)_{receding}} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^2 \tag{27}$$

Please note that both the relations are independent of the observed redshift. This is for further study.

2.4. To Understand The Cosmological Thermodynamic Light Emission Mechanism in Hydrogen Atom

Physicists of the particle data group say [63]: "It is very tempting to make an analogy between the status of the cosmological 'Standard Model' and that of particle physics. In cosmology there are about 10 free parameters, each of which is becoming well determined, and with a great deal of consistency between different measurements. However, none of these parameters can be calculated from a fundamental theory, and so hints of the bigger picture, 'physics beyond the Standard

Model,' are being searched for with ever more ambitious experiments. Despite this analogy, there are some basic differences. For one thing, many of the cosmological parameters change with cosmic epoch, and so the measured values are simply the ones determined today, and hence they are not 'constants,' like particle masses for example (although they are deterministic, so that if one knows their values at one epoch, they can be calculated at another). Moreover, the parameter set is not as well defined as it is in the particle physics Standard Model; different researchers will not necessarily agree on which parameters should be considered as free, and the set can be extended as the quality of the data improves. In a more general sense, the cosmological 'Standard Model' is much further from the underlying 'fundamental theory,' which will ultimately provide the values of the parameters from first principles. Nevertheless, any genuinely complete 'theory of everything' must include an explanation for the values of these cosmological parameters as well as the parameters of the Standard Model of particle physics".

Current magnitude of Hubble constant [64-67] is (67.80 ± 0.77) km/sec/Mpc, (68.1 ± 1.2) km/sec/Mpc, (67.3 ± 1.2) km/sec/Mpc, (69.7 ± 2.0) km/sec/Mpc, (70.0 ± 2.2) km/sec/Mpc, (70.6 ± 3.3) km/sec/Mpc, (73.8 ± 2.4) km/sec/Mpc, and (72.5 ± 2.5) km/sec/Mpc.

In a cosmological approach with various trial-error methods, at present in hydrogen atom, if $H_0 \cong 71$ km/sec/Mpc, Bohr radius [68] can be fitted as follows.

$$\begin{aligned}
(a_B)_0 &\cong \left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{GM_0}{c^2}\right) \cong \left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{c}{2H_0}\right) \\
&\cong \left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{c}{2H_0}\right) \cong \frac{1}{2}\left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{c}{H_0}\right) \\
&\cong 5.27225 \times 10^{-11} \text{ m.}
\end{aligned} \tag{28}$$

$\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)$ is the electromagnetic and gravitational force ratio of proton. This relation seems to be very simple and needs no further derivation. But reasons must be explored for the factor 2. For any physicist or cosmologist it will be a very big surprise. Note that, this relation is free from the famous reduced Planck's constant, electron rest mass and other arbitrary numbers or coefficients. After simplification and considering the ground state, it is possible to express the ground state potential energy of electron in the following way.

$$\left(E_{\text{pot}}\right)_0 \cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 c^2}{4\pi\varepsilon_0 G M_0}\right) \cong -2\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0 (c/H_0)}\right) \tag{29}$$

Here $\left(\frac{e^2}{4\pi\varepsilon_0 (c/H_0)}\right) \cong \left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)$ can be called as the current Hubble potential. With this coincidence it can be suggested that, (c/H_0) can be considered as the current gravitational and electromagnetic interaction range.

Characteristic ground state kinetic energy of electron can be expressed in the following way.

$$\begin{aligned}
(E_{\text{kin}})_0 &\cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 c^2}{8\pi\varepsilon_0 G M_0}\right) \cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0}\right)\left(\frac{c^2}{2GM_0}\right) \\
&\cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)
\end{aligned} \tag{30}$$

Characteristic ground state total energy of electron can be expressed in the following way.

$$
\begin{aligned}
\left(E_{\text{tot}}\right)_0 &\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2c^2}{8\pi\varepsilon_0 G M_0}\right) \cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0}\right)\left(\frac{c^2}{2GM_0}\right)\\
&\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)
\end{aligned} \tag{31}
$$

If $H_0 \cong 71$ km/sec/Mpc, $\left(E_{\text{tot}}\right)_0 \cong -13.66$ eV. Based on this coincidence, this proposed new concept can be given some consideration and it can be suggested that the best value of H_0 lies in between 70 and 71 km/sec/Mpc. Unfortunately these relations seem to be independent of the reduced Planck's constant [69,70]. If one is willing to linkup these relations with the observed 'discrete' energy spectrum of the hydrogen atom, then the desired cosmological light emission mechanism can be developed in a unified picture. At present, by considering the concept of stationary orbits and jumping nature of electron, emitted photon energy can be expressed in the following way.

$$
\left(E_{photon}\right)_0 \cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right] \cong \frac{hc}{\lambda_0} \tag{32}
$$

where $n_1 = n_2 \cong 1,2,3,..$ and $n_2 > n_1$. λ_0 is the wavelength of photon in the laboratory.

The best fit of H_0 can be obtained in the following way.

$$
\left.
\begin{aligned}
&\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right) \cong \frac{e^4 m_e}{32\pi^2\varepsilon_0^2\hbar^2}\\
&\text{and } H_0 \cong \frac{G m_p^2 m_e c}{2\hbar^2} \cong 70.738 \text{ km/sec/Mpc}
\end{aligned}
\right\} \tag{33}
$$

Even though obtained value is matching with the current estimates of the Hubble's constant, literally its meaning seems to be puzzling. On simplification, relation (32) can be expressed as follows.

$$
\sqrt{\left(\frac{Gm_e}{c^2}\right)\left(\frac{GM_0}{c^2}\right)} \cong \frac{G\sqrt{m_e M_0}}{c^2} \cong \frac{\hbar}{m_p c} \tag{34}
$$

Here, RHS is a characteristic length involved with cosmic expansion and LHS is connected with a characteristic quantum length. Now the fundamental question to be answered is - How to correlate these two lengths? If it is assumed that, by this time if the expanding universe is coming to a halt or current rate of expansion is saturated with the saturated Hubble constant $H_{sat} \cong H_0$,' then

$$
\sqrt{\left(\frac{Gm_e}{c^2}\right)\left(\frac{GM_{sat}}{c^2}\right)} \cong \frac{G\sqrt{m_e M_{sat}}}{c^2} \Rightarrow \frac{\hbar}{m_p c} \tag{35}
$$

where $M_{sat} \cong \left(c^3/2GH_{sat}\right)$ can be called as the saturated mass of the current black hole universe. Clearly speaking, for the growing black hole universe, Compton wave length of proton may be playing a crucial role in stopping the its current expansion. One can see similar concepts and similar relations in Appendix-1. At any time in the past - in support of the proposed cosmological red shift interpretation, above relations can be re-expressed as follows.

$$
\left(E_{\text{pot}}\right)_t \cong -\left(\frac{T_0}{T_t}\right)\left(\frac{e^4 m_e}{16\pi^2\varepsilon_0^2\hbar^2}\right) \cong -\left(\frac{T_0}{T_t}\right)\frac{e^4 m_e}{16\pi^2\varepsilon_0^2\hbar^2} \tag{36}
$$

$$
\left(E_{\text{tot}}\right)_t \cong -\left(\frac{T_0}{T_t}\right)\left(\frac{e^4 m_e}{32\pi^2\varepsilon_0^2\hbar^2}\right) \tag{37}
$$

This can be considered as the base for the 'cosmological thermodynamic light emission mechanism'. At any time in the past, at any galaxy, emitted photon energy can be expressed as follows.

$$\left(E_{photon}\right)_t \cong \left(\frac{T_0}{T_t}\right)\left(\frac{e^4 m_e}{32\pi^2\varepsilon_0^2\hbar^2}\right)\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right] \cong \frac{hc}{\lambda_t} \tag{38}$$

where λ_t is the wavelength of photon received from the galactic photon .

Now the observed redshift of photon can be interpreted as follows.

$$z_0 \cong \left(\frac{\lambda_t-\lambda_0}{\lambda_0}\right) \cong \frac{\lambda_t}{\lambda_0}-1 \cong \frac{\left(E_{photon}\right)_0-\left(E_{photon}\right)_t}{\left(E_{photon}\right)_t} \cong \frac{T_t}{T_0}-1 \tag{39}$$

Here z_0 can be called as the current redshift of the photon emitted from the galactic hydrogen atom when the CMBR temperature was T_t . In future, for any galactic hydrogen atom or laboratory hydrogen atom,

$$z_f \cong \left(\frac{\lambda_0-\lambda_t}{\lambda_t}\right) \cong \frac{\lambda_0}{\lambda_t}-1 \cong \frac{\left(E_{photon}\right)_t-\left(E_{photon}\right)_0}{\left(E_{photon}\right)_0} \cong \frac{T_0}{T_t}-1 \tag{40}$$

E_f is the energy of photon emitted from laboratory hydrogen atom after some time in future. E_0 is the energy of current photon emitted from laboratory hydrogen atom. z_f and $\left[d\left(z_f\right)/dt\right]$ can be considered as an index of the absolute rate of cosmic expansion.

3. CONNECTING COSMIC THERMAL AND PHYSICAL PARAMETERS

3.1 Direct Fitting Of The Two Current CMBR Wavelengths

Note that the spectrum from Planck's law of black body radiation takes a different shape in the frequency domain from that of the wavelength domain, the frequency location of the peak emission does not correspond to the peak wavelength using the simple relationship between frequency, wavelength, and the speed of light. In other words, the peak wavelength and the peak frequency do not correspond. The frequency form of Wien's displacement law is derived using similar methods, but starting with Planck's law in terms of frequency instead of wavelength. The effective result is to substitute 3 for 5 in the equation for the peak wavelength. From Planck’s quantum theory of light if $x \cong 4.965114231744276...$ and $y \cong 2.82143937212...$ it is possible to say that [71],

$$\sqrt{\frac{c}{\lambda_m f_m}} \cong \sqrt{\frac{x}{y}} \cong \sqrt{1.75978} \cong 1.326567 \cong \gamma \tag{41}$$

where λ_m and f_m are the peak wavelength in wavelength domain and peak frequency in frequency domain respectively. Let λ_f is the wavelength corresponding to $\frac{dE_\nu}{d\nu}$ and E_ν is the total energy at all frequencies up to and including ν, at any given cosmic time. λ_m is the wavelength corresponding to $\frac{dE_\lambda}{d\lambda}$ and E_λ is the total energy at all wavelengths up to and including λ .

Considering the observed CMBR wavelengths, it is possible to express both the wavelengths in the following way.

$$\left[\left(\lambda_m\right)_t \text{ and } \left(\lambda_f\right)_t\right] \propto \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \tag{42}$$

$$\left[\left(\lambda_m\right)_t \text{ and } \left(\lambda_f\right)_t\right] \propto \sqrt{\left(\frac{4\pi G M_t}{c^2}\right)\cdot\left(\frac{4\pi G M_S}{c^2}\right)} \tag{43}$$

Guessing in this way it is noticed that,

$$\left(\lambda_f\right)_t \cong \gamma \cdot \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \tag{44}$$

$$\left(\lambda_m\right)_t \cong \left(\frac{1}{\gamma}\right) \cdot \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \tag{45}$$

Thus it is possible to express both the wavelength relations in the following way.

$$\left.\begin{aligned}\left(\lambda_f,\lambda_m\right)_t &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \\ &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{H_S}{H_t}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_t}}\end{aligned}\right\} \tag{46}$$

Alternatively geometric mean of $\left(\lambda_f,\lambda_m\right)_t$ can be expressed as follows.

$$\sqrt{\left(\lambda_m\right)_t\left(\lambda_f\right)_t} \cong \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \cong \sqrt{1+\ln\left(\frac{H_S}{H_t}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_t}} \tag{47}$$

At present, if H_0 is close to 71 km/sec/Mpc,

$$\left.\begin{aligned}\left(\lambda_f,\lambda_m\right)_0 &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{M_0}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_0 M_S}}{c^2} \\ &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{H_S}{H_0}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_0}} \cong \left(1.891\text{ mm},\ 1.0744\text{ mm}\right)\end{aligned}\right. \tag{48}$$

Now the observed fluctuations in the CMBR temperature i.e. the CMB anisotropy can be fitted in the following way.

$$\frac{\delta T}{T_0} \le \frac{8\pi G a T_0^4}{3H_0^2 c^2} \text{ and } \delta T \le \left(\frac{8\pi G a T_0^4}{3H_0^2 c^2}\right) T_0 \le 133\ \mu\text{K} \tag{49}$$

At any time in the past, the CMB anisotropy can be guessed in the following way.

$$\frac{\delta T}{T_t} \le \left(\frac{8\pi G a T_t^4}{3H_t^2 c^2}\right) \text{ and } \delta T \le \left(\frac{8\pi G a T_t^4}{3H_t^2 c^2}\right) T_t \tag{50}$$

At any time matter-energy density can be considered as the geometric mean density of volume energy density and the thermal energy density and it can be expressed with the following semi empirical relation.

$$\left(\rho_m\right)_t c^2 \cong \sqrt{\left(\frac{3H_t^2 c^2}{8\pi G}\right)\left(aT_t^4\right)} \text{ and } \left(\rho_m\right)_t \cong \frac{1}{c^2}\sqrt{\left(\frac{3H_t^2 c^2}{8\pi G}\right)\left(aT_t^4\right)} \tag{51}$$

At present, if H_0 is close to 71 km/sec/Mpc, matter density can be fitted as follows.

$$\left.\begin{aligned}&\left(\rho_m\right)_0 c^2 \cong \sqrt{\left(\frac{3H_0^2 c^2}{8\pi G}\right)\left(aT_0^4\right)} \text{ and} \\ &\left(\rho_m\right)_0 \cong \frac{1}{c^2}\sqrt{\left(\frac{3H_0^2 c^2}{8\pi G}\right)\left(aT_0^4\right)} \cong 6.0\times 10^{-32}\text{ gram}/\text{cm}^3\end{aligned}\right\} \tag{52}$$

Based on the average mass-to-light ratio for any galaxy present matter density can be expressed with the following relation [72].

$$(\rho_m)_0 \cong 1.5\times 10^{-32}\eta h_0 \ \text{ gram/cm}^3 \tag{53}$$

Here $\eta \cong \left\langle \frac{M}{L} \right\rangle_{\text{galaxy}} \Big/ \left\langle \frac{M}{L} \right\rangle_{\text{sun}}$, $h_0 \cong H_0/100$ Km/sec/Mpc $\cong 0.71$ Note that elliptical galaxies probably comprise about 60% of the galaxies in the universe and spiral galaxies thought to make up about 20% percent of the galaxies in the universe. Almost 80% of the galaxies are in the form of elliptical and spiral galaxies. For spiral galaxies, $\eta h_0^{-1} \cong 9 \pm 1$ and for elliptical galaxies, $\eta h_0^{-1} \cong 10 \pm 2$ For our galaxy inner part, $\eta h_0^{-1} \cong 6 \pm 2$. Thus the average ηh_0^{-1} is very close to 8 to 9 and its corresponding matter density is close to (6.0 to 6.7) $\times$ 10^{-32} gram/cm^3 and can be compared with the above proposed magnitude of 6.0×10^{-32} gram/cm^3.

3.2 To Understand The True Cosmic Rate Of Expansion With Inverse Of The Fine Structure Ratio

With reference to $(\lambda_m)_t$ and Wien's displacement constant, from above relations $k_B T_t$ can be expressed as follows.

$$\left.\begin{aligned} T_t &\cong \frac{2.898\times 10^{-3}}{(\lambda_m)_t} \cong \left(\frac{hc}{xk_B}\right)\left(\frac{1}{(\lambda_m)_t}\right) \\ \Rightarrow\ T_t &\cong \left(\frac{\gamma}{x}\right)\sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}} \cdot \left(\frac{hc^3}{4\pi G k_B\sqrt{M_t M_S}}\right) \quad \text{Or} \\ T_t &\cong \left(\frac{\gamma}{x}\right)\sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\left(\frac{M_t}{M_S}\right)} \cdot \left(\frac{hc^3}{4\pi G k_B M_t}\right) \end{aligned}\right\} \tag{54}$$

$$k_B T_t \propto \left(\frac{hc^3}{4\pi G M_t}\right) \cong \frac{hH_t}{2\pi} \cong h\left(\frac{H_t}{2\pi}\right) \tag{55}$$

This relation may not be identical but similar to the famous Hawking's black hole temperature formula [73].

$$k_B T_t \propto \sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\left(\frac{M_t}{M_S}\right)} \tag{56}$$

In this way in a very simple approach observed CMBR and the proposed Black hole universe concepts can be put into a single frame. Here the very interesting and strange observation is that, at present

$$\left(1+\ln\left(\frac{M_0}{M_S}\right)\right)^{-1}\left(\frac{M_0}{M_S}\right) \cong \exp\left(\frac{1}{\alpha}\right) \tag{57}$$

where $\left(\frac{1}{\alpha}\right)$ seem to be the inverse of the fine structure ratio. For any mathematician this seems be a fun. For a cosmologist it may be an accidental coincidence. For any physicist it is an astounding and exciting coincidence. Even though it depends upon one's own choice of scientific interest, from unification point of view, assuming it to be a cosmological variable it is possible to express $\left(\frac{1}{\alpha}\right)$ in the following way.

$$\left(\frac{1}{\alpha}\right)_0 \cong \ln\left[\left(1+\ln\left(\frac{M_0}{M_S}\right)\right)^{-1}\left(\frac{M_0}{M_S}\right)\right] \cong 137.047 \tag{58}$$

Here $\left(\frac{1}{\alpha}\right)_0$ may be considered as the current magnitude of 'inverse of the fine structure ratio. Whether this is really the inverse of the fine structure constant or something new to be confirmed from further study. This coincidence seems be interesting and very complicated to understand.

In atomic and nuclear physics, the fine-structure ratio (α) is a fundamental physical constant namely the coupling con stant characterizing the strength [74-76] of the electromagnetic interact-ion. Being a dimensionless quantity, it has a c onstant numerical value in all systems of units. Note that, from unification point of view, till today role of dark energy or dark matter is unclear and undecided. Their laboratory or physical existence is also not yet confirmed. In this critical situation this application or coincidence can be considered as a key tool in particle cosmology.

From now onwards, CMBR temperature can be called as '**Comic Black Hole's Thermal Radiation'** temperature and can be expressed as '**CBHTR'** temperature. **From ground based laboratory experiments, it is possible to measure the rate of change in** $\frac{d}{dt}\left(\frac{1}{\alpha_t}\right)$. Hence the absolute cosmic rate of expansion can be measured. Thus at any time based on $\left[\frac{d}{dt}\left[(\lambda_m)_t \text{ and } (\lambda_f)_t\right], \frac{d}{dt}(T_t) \text{ and } \frac{d}{dt}(H_t)\right]$, the absolute cosmic rate of expansion can be confirmed. At present with reference to $\left[\frac{d}{dt}\left[(\lambda_m)_0 \text{ and } (\lambda_f)_0\right], \frac{d}{dt}(T_0) \text{ and } \frac{d}{dt}(H_0)\right]$ current 'true' cosmic rate of expansion can be understood. Drop in current 'cosmic temperature' can be considered as a measure of the current cosmic expansion and 'rate of decrease in current cosmic temperature' can be considered as a measure of the current cosmic 'rate of expansion'. But if rate of decrease in temperature is very small and is beyond the scope of current experimental verification, then the two possible states are: a) cosmic temperature is decreasing at a very slow rate and universe is expanding at a very slow rate and b) there is no 'observable' thermal expansion and there is no 'observable' cosmic expansion. If observed CMBR temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable. Similarly 'rate of decrease in current 'Hubble's constant' can be considered as a measure of current cosmic 'rate of expansion'. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion. Fortunately as per the Cobe/Planck satellite data current CMBR temperature is very smooth and isotropic. and there is no data that refers to the rate of change in the current Hubble's constant. Hence it can be suggested that at present there is no significant cosmic expansion. Even though this suggestion is completely against to the current notion of cosmic acceleration [11,12], based on the proposed arguments, relations and observed data authors request the science community to review the standard cosmology. If observed CMB radiation temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable.

3.3 The Stoney sale temperature and relation between the elementary physical constants

Based on the above heuristic observation and for the assumed initial conditions of the universe , if $M_t \to M_S$, $\left(\frac{1}{\alpha}\right)_S \to 0$. Based on the relation (58), if one is willing to consider the cosmological variable nature of $\left(\frac{1}{\alpha}\right)$, relation (54) can be expressed as follows.

$$T_t \cong \sqrt{\left(e^{\frac{1}{\alpha}}\right)_t \cdot \left(\frac{\gamma b c^2}{4\pi G M_t}\right)} \tag{59}$$

At the beginning of cosmic evolution for the Stoney scale,

$$T_S \cong \left(\frac{\gamma b c^2}{4\pi G M_S}\right) \tag{60}$$

At the Planck scale, assumed temperature can be expressed as,

$$T_S \cong \left(\frac{3H_S^2 c^2}{8\pi G a}\right)^{\frac{1}{4}} \tag{61}$$

Now equating the above two equations, relation between the elementary physical constants can be established in a quantum gravitational approach. It 3.8% error it is noticed that [67],

$$h \cong \left(\frac{45x^2y^2}{\pi^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0 c}\right) \cong 6.883\times 10^{-34} \text{ J.sec} \tag{62}$$

With 1.89% error it is noticed that,

$$M_S \cong \left(\frac{\pi}{xy\sqrt{45}}\right)\sqrt{\frac{hc}{G}} \cong 1.824\times 10^{-9} \text{ kg} \tag{63}$$

3.4 Cosmic Thermal Energy Density, Matter Density And Redshift In a Simplified Approach

In this subsection without considering the numbers (x and y) and without considering the wavelengths of CMBR radiation, authors proposed another simple method of fitting the thermal energy density and matter density. It may be noted that connecting CMBR energy density with Hubble's constant is really a very big task and mostly preferred in cosmology. At any given cosmic time, thermal energy density can be expressed with the following semi empirical relation.

$$aT_t^4 \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\left(\frac{3H_t^2c^2}{8\pi G}\right) \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2}\left(\frac{3H_t^2c^2}{8\pi G}\right) \tag{64}$$

$$T_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-\frac{1}{2}}\left(\frac{3H_t^2c^2}{8\pi G a}\right)^{\frac{1}{4}} \tag{65}$$

By splitting the radiation constant $a \cong \frac{8\pi^5}{15}\frac{k_B^4}{h^3c^3}$ into the elementary physical constants and with reference to the relation (63), relation (54) of above section can be obtained.

Thus at present, if H_0 is close to 71 km/sec/Mpc, obtained CMBR temperature is 2.723 K [66-71]. For the time being this can be considered as a remarkable discovery and an accurate fit.

$$aT_0^4 \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\left(\frac{3H_0^2c^2}{8\pi G}\right) \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2}\left(\frac{3H_0^2c^2}{8\pi G}\right) \tag{66}$$

$$T_0 \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-\frac{1}{2}}\left(\frac{3H_0^2c^2}{8\pi G a}\right)^{\frac{1}{4}} \tag{67}$$

Current temperature fluctuations can be fitted in the following way.

$$\left.\begin{array}{l}\frac{\delta T}{T_0} \leq \left(\frac{8\pi G a T_0^4}{3H_0^2c^2}\right) \leq \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2} \cong 4.90\times10^{-5} \\ \text{and } \delta T \leq 4.90\times10^{-5}T_0 \leq 133\ \mu K\end{array}\right\} \tag{68}$$

From Planck satellite data [64], at present the CMB has a thermal black body spectrum at a temperature of $2.72548 \pm 0.00057\ \mathrm{K} \Rightarrow 2.72548\ \mathrm{K}(\pm\ 570\ \mu\mathrm{K})$. Note that, proposed δT is 133 micro Kelvin and current δT is 570 micro Kelvin. To resolve the issue and understand the rate of decrease in the current cosmic temperature, observational or experimental accuracy of measuring the CMBR temperature must be improved further.

At any time in the past, temperature fluctuations or Anisotropy in CMB can be expressed as follows.

$$\left.\begin{array}{l}\frac{\delta T}{T_t} \cong \left(\frac{8\pi G a T_t^4}{3H_t^2c^2}\right) \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} \\ \text{and } \delta T \leq \left(\frac{8\pi G a T_t^5}{3H_t^2c^2}\right) \leq \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} T_t\end{array}\right\} \tag{69}$$

With reference to the current cosmic temperature, at any time in the past,

$$\frac{T_t}{T_0} \cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right] H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right] H_0}\right\}^{\frac{1}{2}} \tag{70}$$

Using this relation, cosmic redshift data can be fitted. When the assumed CMBR temperature is 2999 K, esti-mated redshift is 1099 and is in very good agreement with the standard model of cosmology.

Mostly at the ending stage of expansion, rate of change in H_t will be practically zero and can be considered as practically constant. Thus at its ending stage of expansion, for the whole cosmic black hole as H_t practically remains constant, its corresponding thermal energy density will be 'the same' throughout its volume. This 'sameness' may be the reason for the observed 'isotropic' nature of the current CMB radiation. With this coincidence it can be suggested that, at the beginning of cosmic evolution,

$$aT_S^4 \cong \left(\frac{3H_S^2c^2}{8\pi G}\right) \tag{71}$$

Matter-energy density can be considered as the geometric mean density of volume energy density and the thermal energy density and it can be expressed with the following semi empirical relation.

$$\begin{array}{l}(\rho_m)_t c^2 \cong \sqrt{\left(\frac{3H_t^2c^2}{8\pi G}\right)\left(aT_t^4\right)} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1} \left(\frac{3H_t^2c^2}{8\pi G}\right) \\ \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-1} \left(\frac{3H_0^2c^2}{8\pi G}\right)\end{array} \tag{72}$$

Here one important observation to be noted is that, at any time

$$\frac{8\pi G(\rho_m)_t}{3H_t^2} \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-1} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1} \cong (\Omega_m)_t \tag{73}$$

Thus at present,

$$\left(\rho_m\right)_0 \cong \frac{1}{c^2}\sqrt{\left(\frac{3H_0^2c^2}{8\pi G}\right)\left(aT_0^4\right)} \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-1}\left(\frac{3H_0^2}{8\pi G}\right)$$
$$\cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-1}\left(\frac{3H_0^2}{8\pi G}\right) \cong 6.6\times10^{-32}\,\text{gram}/\text{cm}^3 \tag{74}$$

3.5 Age Of The Growing Cosmic Black Hole

Age of the growing cosmic black hole can be assumed as the time taken to grow from the assumed Stoney scale to the current scale. At present,

$$g_0 \cong \left(\frac{8\pi GaT_0^4}{3H_0^2c^2}\right)c \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2} c \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2} c \simeq 14.66 \text{ km/sec} \tag{75}$$

Clearly speaking, at present, Hubble volume is growing at 14.66 km/sec in a decelerating trend. Starting from the Stoney scale, if the assumed growth rate is gradually decreasing, at any time average growth rate can be expressed as follows.

$$\frac{g_S+g_t}{2} \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\right\}c \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2}\right\}c \tag{76}$$

For the current scale, average growth rate can be expressed as follows.

$$\frac{g_S+g_0}{2} \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2}\right\}c \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}c \tag{77}$$

Time taken to reach from the Stoney scale to any assumed scale can be expressed as follows.

$$\left(\frac{g_S+g_t}{2}\right)t \cong \left(R_t - R_S\right) \cong R_t \tag{78}$$

where, $R_t \ggg R_S$ and $R_S \approx 0$. Hence for the current scale,

$$\left(\frac{g_S+g_0}{2}\right)t_0 \cong \left(R_0 - R_S\right) \cong R_0 \cong \frac{c}{H_0} \tag{79}$$

$$t_0 \cong \left(\frac{g_S+g_0}{2}\right)^{-1}\frac{c}{H_0} \cong \left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}^{-1}\frac{2}{H_0} \cong 27.496 \text{ Gyr.} \tag{80}$$

where $\left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}^{-1} \cong 0.99995.$

This proposal is for further study. Based on this proposal, after one second from the Stoney scale, cosmic angular velocity is 2 rad/sec, growth rate is 29 km/sec and cosmic temperature is 3×10^9 K. With reference to the current and past cosmic temperatures, at any time in the past, at any galaxy, for any hydrogen atom,

$$\frac{E_0}{E_t} \cong \frac{\lambda_t}{\lambda_0} \cong \frac{T_t}{T_0} \cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}} \cong \left\{\frac{\left[1+\ln\left(\frac{R_0}{R_S}\right)\right]R_0}{\left[1+\ln\left(\frac{R_t}{R_S}\right)\right]R_t}\right\}^{\frac{1}{2}} \cong \left\{\frac{\left(\Omega_m\right)_t H_t}{\left(\Omega_m\right)_0 H_0}\right\}^{\frac{1}{2}} \tag{81}$$

By guessing H_t, $\left(z_0+1\right)$ can be estimated. It seems to be a full and absolute definition for the cosmic redshift. Thus at any time in the past,

$$\left(\frac{E_0}{E_t}-1\right)\cong\left(\frac{\lambda_t}{\lambda_0}-1\right)\cong\left(\frac{T_t}{T_0}-1\right)\cong\left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}}-1\cong\left\{\frac{(\Omega_m)_t\ H_t}{(\Omega_m)_0\ H_0}\right\}^{\frac{1}{2}}-1\cong z_0 \tag{82}$$

Please see the following table-1 for the cosmic physical and thermal parameters. This table prepared with C++ program with reference to the observed 2.725 K.

In this table:
Column-1 = Assumed cosmic angular velocity.
Column-2 = Estimated cosmic radius, from relation (7).
Column-3 = Estimated cosmic mass, from relation (7).
Column-4 = Estimated cosmic growth index, from relation (11).
Column-5 = Estimated cosmic growth rate, from relation (13).
Column-6 = Estimated cosmic time, from relation (78).
Column-7 = Estimated cosmic temperature, from relation (65)
Column-8 = Estimated cosmic redshift, from relation (82)

Table-1: Assumed Cosmic angular velocity and estimated other cosmic physical and thermal parameters

Assumed Cosmic Angular velocity (rad/sec)	**Estimated Cosmic radius** (meter)	**Estimated Cosmic mass** (kg)	Cosmic Growth index $\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^2$ (number)	**Estimated Cosmic Growth rate** (km/sec)	**Estimated Cosmic time** (sec)	**Estimated Cosmic temperature** (K)	**Estimated Cosmic Redshift** z_0 (number)
1.086E+44	**2.761E-36**	**1.859E-09**	**1**	**299792**	**0.000E+00**	**2.237E+32**	**8.207E+31**
2.305E+43	1.301E-35	8.759E-09	6.50173	46109.6	5.924E-44	6.455E+31	2.368E+31
2.305E+42	1.301E-34	8.759E-08	23.5461	12732.1	8.148E-43	1.480E+31	5.428E+30
2.305E+41	1.301E-33	8.759E-07	51.1943	5855.97	8.493E-42	3.853E+30	1.414E+30
2.305E+40	1.301E-32	8.759E-06	89.4463	3351.65	8.580E-41	1.060E+30	3.888E+29
2.305E+39	1.301E-31	8.759E-05	138.302	2167.66	8.615E-40	3.006E+29	1.103E+29
2.305E+38	1.301E-30	8.759E-04	197.762	1515.93	8.634E-39	8.692E+28	3.189E+28
2.305E+37	1.301E-29	8.759E-03	267.825	1119.36	8.645E-38	2.548E+28	9.347E+27
2.305E+36	1.301E-28	8.759E-02	348.492	860.256	8.653E-37	7.544E+27	2.768E+27
2.305E+35	1.301E-27	8.759E-01	439.763	681.714	8.658E-36	2.251E+27	8.258E+26
2.305E+34	1.301E-26	8.759E+00	541.638	553.492	8.662E-35	6.756E+26	2.479E+26
2.305E+33	1.301E-25	8.759E+01	654.116	458.317	8.665E-34	2.038E+26	7.477E+25
2.305E+32	1.301E-24	8.759E+02	777.199	385.735	8.667E-33	6.173E+25	2.265E+25
2.305E+31	1.301E-23	8.759E+03	910.885	329.122	8.668E-32	1.876E+25	6.883E+24
2.305E+30	1.301E-22	8.759E+04	1055.17	284.116	8.670E-31	5.719E+24	2.098E+24
2.305E+29	1.301E-21	8.759E+05	1210.07	247.748	8.671E-30	1.748E+24	6.411E+23
2.305E+28	1.301E-20	8.759E+06	1375.57	217.941	8.671E-29	5.352E+23	1.964E+23
2.305E+27	1.301E-19	8.759E+07	1551.67	193.207	8.672E-28	1.642E+23	6.025E+22
2.305E+26	1.301E-18	8.759E+08	1738.37	172.456	8.673E-27	5.048E+22	1.852E+22
2.305E+25	1.301E-17	8.759E+09	1935.68	154.877	8.673E-26	1.554E+22	5.701E+21
2.305E+24	1.301E-16	8.759E+10	2143.59	139.855	8.674E-25	4.790E+21	1.757E+21

2.305E+23	1.301E-15	8.759E+11	2362.11	126.917	8.674E-24	1.478E+21	5.424E+20
2.305E+22	1.301E-14	8.759E+12	2591.23	115.695	8.674E-23	4.568E+20	1.676E+20
2.305E+21	1.301E-13	8.759E+13	2830.96	105.898	8.675E-22	1.413E+20	5.184E+19
2.305E+20	1.301E-12	8.759E+14	3081.28	97.2947	8.675E-21	4.375E+19	1.605E+19
2.305E+19	1.301E-11	8.759E+15	3342.21	89.6987	8.675E-20	1.356E+19	4.973E+18
2.305E+18	1.301E-10	8.759E+16	3613.75	82.9588	8.675E-19	4.204E+18	1.542E+18
2.305E+17	1.301E-09	8.759E+17	3895.89	76.951	8.676E-18	1.305E+18	4.786E+17
2.305E+16	1.301E-08	8.759E+18	4188.63	71.5729	8.676E-17	4.052E+17	1.486E+17
2.305E+15	1.301E-07	8.759E+19	4491.98	66.7395	8.676E-16	1.259E+17	4.619E+16
2.305E+14	1.301E-06	8.759E+20	4805.93	62.3797	8.676E-15	3.915E+16	1.436E+16
2.305E+13	1.301E-05	8.759E+21	5130.48	58.4336	8.676E-14	1.218E+16	4.468E+15
2.305E+12	1.301E-04	8.759E+22	5465.64	54.8504	8.676E-13	3.791E+15	1.391E+15
2.305E+11	1.301E-03	8.759E+23	5811.41	51.5869	8.676E-12	1.180E+15	4.331E+14
2.305E+10	1.301E-02	8.759E+24	6167.77	48.6063	8.676E-11	3.678E+14	1.349E+14
2.305E+09	1.301E-01	8.759E+25	6534.74	45.8767	8.676E-10	1.146E+14	4.206E+13
2.305E+08	1.301E+00	8.759E+26	6912.31	43.3708	8.677E-09	3.575E+13	1.311E+13
2.305E+07	1.301E+01	8.759E+27	7300.49	41.0647	8.677E-08	1.115E+13	4.091E+12
2.305E+06	1.301E+02	8.759E+28	7699.27	38.9378	8.677E-07	3.480E+12	1.277E+12
2.305E+05	1.301E+03	8.759E+29	8108.66	36.9719	8.677E-06	1.086E+12	3.985E+11
2.305E+04	1.301E+04	8.759E+30	8528.65	35.1512	8.677E-05	3.392E+11	1.244E+11
2.305E+03	1.301E+05	8.759E+31	8959.24	33.4618	8.677E-04	1.059E+11	3.887E+10
2.305E+02	1.301E+06	8.759E+32	9400.43	31.8913	8.677E-03	3.310E+10	1.214E+10
2.305E+01	1.301E+07	8.759E+33	9852.23	30.4289	8.677E-02	1.035E+10	3.796E+09
2.305E+00	**1.301E+08**	**8.759E+34**	**10314.6**	**29.0648**	**8.677E-01**	**3.234E+09**	**1.187E+09**
2.305E-01	1.301E+09	8.759E+35	10787.6	27.7904	8.677E+00	1.011E+09	3.710E+08
2.305E-02	1.301E+10	8.759E+36	11271.3	26.598	8.677E+01	3.163E+08	1.161E+08
2.305E-03	1.301E+11	8.759E+37	11765.5	25.4807	8.677E+02	9.897E+07	3.631E+07
2.305E-04	1.301E+12	8.759E+38	12270.3	24.4324	8.677E+03	3.097E+07	1.136E+07
2.305E-05	1.301E+13	8.759E+39	12785.7	23.4475	8.677E+04	9.693E+06	3.556E+06
2.305E-06	1.301E+14	8.759E+40	13311.7	22.5209	8.677E+05	3.034E+06	1.113E+06
2.305E-07	1.301E+15	8.759E+41	13848.4	21.6482	8.677E+06	9.501E+05	3.486E+05
2.305E-08	1.301E+16	8.759E+42	14395.6	20.8253	8.677E+07	2.976E+05	1.092E+05
2.305E-09	1.301E+17	8.759E+43	14953.4	20.0484	8.677E+08	9.321E+04	3.419E+04
2.305E-10	1.301E+18	8.759E+44	15521.9	19.3142	8.677E+09	2.920E+04	1.071E+04
2.305E-11	1.301E+19	8.759E+45	16100.9	18.6196	8.677E+10	9.150E+03	3.356E+03
2.52E-12	**1.19E+20**	**8.01E+46**	**16667.6**	**17.9865**	**7.94E+11**	**2998.85**	**1099.21**
2.305E-12	**1.301E+20**	**8.759E+46**	**16690.6**	**17.9618**	**8.677E+11**	**2.868E+03**	**1.051E+03**
2.305E-13	1.301E+21	8.759E+47	17290.8	17.3382	8.677E+12	8.988E+02	3.288E+02
2.305E-14	1.301E+22	8.759E+48	17901.7	16.7466	8.677E+13	2.818E+02	1.024E+02
2.305E-15	1.301E+23	8.759E+49	18523.2	16.1847	8.677E+14	8.835E+01	3.141E+01
2.305E-16	1.301E+24	8.759E+50	19155.2	15.6507	8.677E+15	2.771E+01	9.164E+00
2.305E-17	1.301E+25	8.759E+51	19797.9	15.1427	8.677E+16	8.689E+00	2.188E+00
2.305E-18	**1.301E+26**	**8.759E+52**	**20451.2**	**14.6589**	**8.677E+17**	**2.726E+00**	**0.000E+00**

4. GALACTIC ROTATIONAL CURVES IN THE CURRENT BLACK HOLE UNIVERSE

With reference to the Modified Newtonian Dynamics (simply, MOND) results [17-21], empirically rotational speed of a star is being represented as

$$v_s \cong \sqrt[4]{GMa_0} \tag{83}$$

where $a_0 \cong (1.2 \pm 0.3) \times 10^{-10}\ m.\sec^{-2} \approx cH_0/2\pi$, and M is the mass of galaxy. In the light speed rotating black hole universe,

1) The acceleration constant a_0 is not a constant but a variable and depends on the galactic revolving speed about the center of the light speed rotating black hole universe.
2) Its magnitude can be assumed to be proportional to the current Hubble constant and can be called as the cosmological galactic acceleration.
3) By considering the galactic revolving speed V_g about the center of the cosmic black hole, magnitude of (cH_0) can be assumed to vary in the following way.

$$\left(V_g/c\right)(cH_0) \cong (V_g H_0) \cong a_g \cong r_g H_0^2. \tag{84}$$

where r_g is the distance between the galaxy and the cosmic black hole center. Thus authors replace the empirical acceleration constant a_0 with (a variable) cosmological galactic acceleration, $a_g \cong V_g H_0$. Now rotational speed of a star in any galaxy can be represented as follows.

$$v_s \cong \sqrt[4]{GM(\mathrm{V}_g H_0)} \tag{85}$$

Here if it is assumed that, galaxies under observation possesses a cosmological revolving speed in the range 0.1 to 0.25 times the speed of light currently observed all galactic rotational speeds can be fitted well. If current $H_0 \cong 68$ km/sec/Mpc, $0.1(cH_0) \cong 0.66 \times 10^{-10} m.\sec^{-2}$ and $0.25(cH_0) \cong 1.65 \times 10^{-10} m.\sec^{-2}$. Advantage of this proposal is that, by knowing the galactic mass and rotational speeds of its stars, galactic revolving speed and hence distance between galaxy and the cosmic black hole center can be estimated. This is for further study. It is true that this proposal is 1) Qualitatively suitable for understanding the galactic rotation curves in the light of light speed cosmic rotation. 2) By knowing the galactic rotational speeds quantitatively suitable for estimating the galactic cosmological revolution speed and distance from the cosmic center.

5. CONCLUSIONS

5.1 Need Of The Mass Unit $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ In Unification

The basic idea of unification is – 1) To minimize the number of physical constants and to merge a group of different fundamental constants into one compound physical constant with appropriate unified interpretation and 2) To merge and minimize various branches of physics. In this regard instead of Planck mass, $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ can be considered as the nature's given true unified mass unit. See appendix-2 for its applications in particle cosmology.

5.2 To Consider The Universe As A Growing And Light Speed Rotating Primordial Black Hole

If ‘black hole geometry’ is more intrinsic compared to the black hole ‘mass’ and ‘density’ parameters, if universe constitutes so many galaxies and if each galaxy constitutes a central growing and fast spinning black hole then considering universe as a ‘growing and light speed rotating primordial black hole’ may not be far away from reality. If universe is having no black hole geometry - any massive body (which is bound to the universe) may not show a black hole structure. That is black hole structure or geometry may be a subset of the cosmic geometry. At this juncture considering or rejecting this proposal completely depends on the observed cosmic redshift. Based on the relations proposed in above sections observed cosmic redshift can be considered as a result of cosmological light emission mechanism. Authors are working on the assumed Hubble volume and Hubble mass in different directions with different applications that connect micro physics and macro physics. Based on the proposed short comings of the standard cosmology, dimensional analysis on the Hubble’s constant, cosmic redshift reinterpretation, numerical data fitting on current CMBR energy density, matter density and CMBR redshift & corresponding temperature - concepts of black hole cosmology may be given at least 99% priority.

5.3 About The Current Cosmic Black Hole’s Deceleration

In view of the applications proposed in above sections and with reference to the zero rate of change in inverse of the fine structure ratio (from ground based experiments), zero rate of change in the ‘current CMBR temperature’ (from Cobe/Planck satellite data) and zero rate of change in the ‘current Hubble’s constant’ (from Cobe/Planck satellite data) it can be suggested that, current cosmic expansion is almost all saturated and at present there is no significant cosmic acceleration. Clearly speaking, Stoney scale cosmic black hole’s growth rate is equal to the speed of light and current cosmic black hole is growing at 14.66 km/sec in a decelerating trend. It can also be possible to suggest that currently believed ‘dark energy’ is a pure, ‘mathematical concept’ and there exists no physical base behind its confirmation. Now the key leftover things are nucleosynthesis and structure formation. Authors are working in this direction. As nuclear binding energy was zero at the beginning of cosmic evolution, by considering the time dependent variable nature of magnitudes of the semi empirical mass formula energy coefficients it is possible to show that, at the beginning of formation of nucleons, nuclear stability is maximum for light atoms only. If so it can be suggested that, from the beginning of formation of nucleons, in any galaxy, maximum scope is being possible only for the survival of light atoms and this may be the reason for the accumulation and abundance of light atoms in large proportion.

5.4 Reviewing The Basics Of Inflation With Black Hole Cosmology

A recurrent criticism of inflation is that the invoked inflation field does not correspond to any known physical field and that its potential energy curve seems to be an ad hoc means to accommodate almost any data obtainable [14]. Anyhow, with reference to the past and current Hubble volumes, and by comparing the concepts, results and outcomes that can be obtained with the proposed model of black hole cosmology, in coming future, the need of inflation can be reviewed.

APPENDIX-1: TO UNDERSTAND THE PHYSICAL SIGNIFICANCE OF LARGE NUMBERS IN COSMOLOGY

Great cosmologists proposed many interesting large numbers in cosmology [77-84]. Ultimately the essence of any cosmological number or ratio is to connect the microscopic and macroscopic physical constants with a possible physical meaning with in the ‘evolving universe’. Clearly speaking large dimensionless constants and compound physical constants must reflect an ‘observable’ intrinsic property of any natural physical phenomenon. Then only the real meaning of any cosmological number can be explored. In this regard authors proposed many interesting relations in the previous sections of this paper. Authors noticed that uncertainty relation or Planck’s constant or reduced Planck’s constant or inverse of the Fine structure ratio or characteristic nuclear potential radius or rms radius of proton or classical radius of electron - play a crucial role in the understanding the halt of cosmic expansion. The basic questions to be answered are: 1) The general idea of large number coincidence is interesting, yet is there any observational proves? and 2) How Einstein’s general theory of relativity is fitted in the theory of the large cosmological numbers ? In this regard the characteristic and key relation can be expressed in the following way.

$$\frac{c^3}{2GM_0} \cong H_0 \quad \text{Or} \quad \frac{c^3}{2GH_0} \cong M_0 \tag{1}$$

Here (M_0, H_0) can be considered as the current mass and current angular velocity of the black hole universe respectively. By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\frac{c^3}{2GM_{sat}} \cong H_{sat} \quad \text{Or} \quad \frac{c^3}{2GH_{sat}} \cong M_{sat} \tag{2}$$

Here (M_{sat}, H_{sat}) can be considered as the saturated mass and saturated angular velocity of the black hole universe at its ending stage of expansion. Fortunately it is noticed that, $M_{sat} \cong M_0$ and $H_{sat} \cong H_0$. Authors strongly believe that the following relations certainly help in understanding the mystery of the halting of the present cosmic expansion.

1. Role Of The Uncertainty Relation

It is noticed that,

$$\frac{Gm_p m_e}{R_p H_0} \cong \frac{h}{4\pi} \tag{3}$$

Here $R_p \cong (0.84184 \text{ to } 0.87680)$ fm is the rms radius of proton [67,85]. After re-arranging, it can be expressed in the following way.

$$\left(\frac{2Gm_p}{c^2 R_p}\right)\frac{m_e c^2}{H_0} \cong \left(\frac{2Gm_p}{c^2 R_p}\right)\left[m_e c\left(\frac{2\pi c}{H_0}\right)\right] \cong h \tag{4}$$

By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\begin{gathered} H_{sat} \Rightarrow \frac{4\pi G m_p m_e}{hR_p} \cong \frac{Gm_p m_e}{(h/4\pi)R_p} \\ \Rightarrow H_{sat} \cong (67.87 \text{ to } 70.69) \text{ km/sec/Mpc} \end{gathered} \tag{5}$$

This is a remarkable fit and needs further study.

2. Role Of The Classical Radius Of Electron

It is noticed that,

$$\begin{gathered} \sqrt{\left(\frac{2G\sqrt{m_p m_e}}{c^2}\right)\left(\frac{c}{H_0}\right)} \\ \cong \sqrt{\left(\frac{2G\sqrt{m_p m_e}}{c^2}\right)\left(\frac{2GM_0}{c^2}\right)} \cong \left(\frac{e^2}{4\pi\varepsilon_0 m_e c^2}\right) \end{gathered} \tag{6}$$

$\left(\frac{e^2}{4\pi\varepsilon_0 m_e c^2}\right)$ is nothing but the presently believed classical radius of electron. In a broad picture or considering the interaction in between proton and electron it is a very general idea to consider the geometric mean mass of proton and electron. By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\left(\frac{c}{H_{sat}}\right) \Rightarrow \left(\frac{e^2}{4\pi\varepsilon_0 m_e c^2}\right)^2 \left(\frac{c^2}{2G\sqrt{m_p m_e}}\right) \tag{7}$$

$$H_{sat} \Rightarrow \frac{2G\sqrt{m_p m_e}}{c}\left(\frac{4\pi\varepsilon_0 m_e c^2}{e^2}\right)^2 \cong 67.533 \text{ km/sec/Mpc} \tag{8}$$

This is also a remarkable fit and needs further study.

3. Role Of The Characteristic Nuclear Potential Radius Or The Compton Wavelength of Pion

It is noticed that,

$$\frac{G\sqrt{M_0\sqrt{m_p m_e}}}{c^2} \cong \sqrt{\left(\frac{GM_0}{c^2}\right)\left(\frac{G\sqrt{m_p m_e}}{c^2}\right)} \cong 1.4\times 10^{-15} \text{ m} \cong R_n \tag{9}$$

R_n is nothing but the presently believed characteristic nuclear potential radius [86] or the nuclear strong interaction range as proposed by Yukawa [87]. By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows [88-90].

$$\frac{G\sqrt{M_{sat}\sqrt{m_p m_e}}}{c^2} \Rightarrow R_n \cong \frac{\hbar}{m_\pi c} \cong 1.4 \text{ fm} \tag{10}$$

where m_π is the rest mass of charged pion.

$$H_{sat} \Rightarrow \frac{G\sqrt{m_p m_e}}{2cR_n^2} \cong 67.0 \text{ km/sec/Mpc} \tag{11}$$

This is also a remarkable coincidence and accuracy mainly depends upon the magnitude of the characteristic nuclear potential radius. Further study may reveal the mystery.

4 Role Of The 'Inverse' Of The Fine Structure Ratio

In a cosmological approach fine structure ratio can be fitted in the following way [78-80]. Total thermal energy in the present Hubble volume can be expressed as follows.

$$(E_T)_0 \cong aT_0^4 \cdot \frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3 \tag{12}$$

Thermal energy present in half of the current Hubble volume can be expressed as follows.

$$\frac{(E_T)_0}{2} \cong \frac{1}{2}\left[aT_0^4 \cdot \frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3\right] \tag{13}$$

If (c/H_0) is the present electromagnetic interaction range, then present characteristic Hubble potential can be expressed as

$$(E_e)_0 \cong \frac{e^2}{4\pi\varepsilon_0 (c/H_0)} \cong \frac{e^2 H_0}{4\pi\varepsilon_0 c} \tag{14}$$

If H_0 is close to 71 km/sec/Mpc and $T_0 \cong 2.725$ K, it is noticed that,

$$\ln\sqrt{\frac{\left[(E_T)_0/2\right]}{(E_e)_0}} \cong 137.05 \tag{15}$$

By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\ln\sqrt{\frac{\left[(E_T)_0/2\right]}{(E_e)_0}} \cong \ln\sqrt{\frac{\left[(E_T)_{sat}/2\right]}{(E_e)_{sat}}} \Rightarrow \left(\frac{1}{\alpha}\right) \tag{16}$$

$(E_T)_{sat}$ can be considered as the total thermal energy in the Hubble volume at the end of cosmic expansion.

$(E_e)_{sat}$ can be considered as the Hubble potential at the end of cosmic expansion.

APPENDIX-2: APPLICATIONS OF THE STONEY MASS UNIT

Application-1: To Interlink The Rest Masses of Graviton, Proton And Electron

With reference to current models [42-45] and with reference to current saturated Hubble's constant, mass of graviton can be expressed with the following relation.

$$m_g c^2 \cong \hbar H_{sat} \cong \frac{\hbar c^3}{2GM_{sat}} \tag{1}$$

where $M_{sat} \cong \dfrac{c^3}{2GH_{sat}} \cong 9\times10^{52}$ kg. Thus $m_g \cong 2.634\times10^{-69}$ kg, can be called as the mass of graviton. With this proposed graviton mass it is noticed that,

$$\frac{Gm_g M_{sat}}{c} \cong \frac{h}{4\pi} \tag{2}$$

$$\ln\left(\frac{GM_{sat}M_S}{\hbar c}\right) \cong \ln\left(\frac{M_S}{2m_g}\right) \cong 137.1 \cong \frac{1}{\alpha} \tag{3}$$

$$\left.\begin{aligned} \left(\frac{m_p}{m_e}\right)^{\frac{1}{4}}\left(\frac{m_e}{m_g}\right) &\cong \frac{e^2}{4\pi\varepsilon_0 m_p m_e} \cong \frac{M_S^2}{m_p m_e} \\ \Rightarrow m_p &\cong \left(\frac{M_S^8 m_g^4}{m_e^7}\right)^{\frac{1}{5}} \cong \frac{M_S^{8/5} m_g^{4/5}}{m_e^{7/5}} \end{aligned}\right\} \tag{4}$$

Application-2: To Fit The Proton-Electron Mass Ratio And To Fit The Gravitational Constant

Proton-electron mass ratio and proton rest mass can be fitted in the following way.

$$\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}} \cong \frac{\left(M_S m_e^2\right)^{\frac{1}{3}}}{m_p} \tag{5}$$

Here, lhs=6908.3745 and rhs=6899.7363. Accuracy can be improved with the following fitting.

$$\frac{\left(M_S m_e^2\right)^{\frac{1}{3}}}{m_p} \cong \left[\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}}\right] + \ln\left[\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}}\right] \tag{6}$$

From the above relation, magnitude of the gravitational constant [67,95,96] can be fitted in the following way.

$$\left.\begin{array}{l} \text{If } X \cong \left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}} \text{ and } M_S \cong \left[X+\ln(X)\right]^3\left(\frac{m_p^3}{m_e^2}\right) \\ G \cong \frac{e^2}{4\pi\varepsilon_0 M_S^2} \cong 6.672681991\times10^{-11}\ \text{m}^3.\text{kg}^{-1}\text{sec}^{-2} \end{array}\right\} \quad (7)$$

where, $m_p \cong 1.672621777(74)\times10^{-27}$ kg, $m_e \cong 9.109\ 382\ 91(40)\times10^{-31}$ kg, $e \cong 1.602\ 176\ 565(35)\times10^{-19}$ C.

Application-3: Weak mixing angle, Avogadro number, Lepton rest masses and The Strong coupling constant…

$$\left.\begin{array}{r} \text{Let, } A \cong 2\left\{\ln\left(\frac{M_S}{\left(M_S m_e^2\right)^{\frac{1}{3}}}\right)-1\right\} \cong 63.424 \\ B \cong 2\left\{\ln\left(\frac{M_{sat}}{\left(M_S m_e^2\right)^{\frac{1}{3}}}\right)-1\right\} \cong 347.49 \end{array}\right\} \quad (8)$$

$$\left.\begin{array}{l} 2\left(\sqrt{AB}-1\right) \cong 294.913 \cong \gamma \quad \text{(say)} \\ \text{Then, } \sqrt{\frac{A}{2\left(\sqrt{AB}-1\right)}} \cong \sqrt{\frac{A}{\gamma}} \cong \sin\theta_W \cong 0.46375 \end{array}\right\} \quad (9)$$

Here $\sin\theta_W$ can be considered as the Weak mixing angle [63,67]. With reference to the inverse of the Fine structure ratio it is noticed that,

$$B - A - \left(\frac{\gamma-1}{2}\right) \cong 137.11 \cong \frac{1}{\alpha} \quad (10)$$

With reference to $\sin\theta_W$ it is noticed that,

$$\begin{array}{l} \ln\sqrt{\frac{m_n c^2 - m_p c^2}{m_e c^2}} \cong \ln\sqrt{\frac{939.5654-938.272}{0.511}} \\ \cong \sin\theta_W \cong 0.46433 \end{array} \quad (11)$$

where m_n is the rest mass of neutron and m_p is the rest mass of proton. It is also noticed that,

$$\left(\frac{M_{sat}}{\sqrt{M_S m_e}}\right)^{\frac{1}{3}} \sin\theta_W \cong 6.0194\times10^{23} \cong N_A \quad (12)$$

$$\begin{array}{l} \gamma\sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_e^2}} \cong \gamma\left(\frac{M_S}{m_e}\right) \cong 6.0193\times10^{23} \cong N_A \\ \Rightarrow \gamma \cong \frac{N_A m_e}{M_S} \end{array} \quad (13)$$

Muon and Tau rest masses can be fitted with the following relation accurately.

$$\left(m_\mu c^2, m_\tau c^2\right) \cong \left\{\gamma^3 + \left[\left(n^2\gamma\right)^n \sqrt{N_A}\right]\right\}^{\frac{1}{3}}\left(\frac{m_e c^2}{\gamma}\right) \quad (14)$$

where n =1,2.

Now proton rest mass can be fitted with the following relation.

$$m_p c^2 \cong \left[\gamma \ln\left(\gamma + \frac{m_\mu}{m_e}\right)\right] m_e c^2 \cong 937.0\text{MeV} \tag{15}$$

Now nucleon's 1240 resonance state can be fitted with the following relation.

$$\left[\gamma \ln\left(\gamma + \frac{m_\mu}{m_e} + \frac{m_\tau}{m_e}\right)\right] m_e c^2 \cong 1249 \text{ MeV} \tag{16}$$

Here interesting observation is that,

$$\ln\left(\gamma + \frac{m_\mu}{m_e} + \frac{m_\tau}{m_e}\right) \cong 8.29 \cong \frac{1}{0.12} \cong \frac{1}{\alpha_s} \tag{17}$$

Here 8.29 is close to the presently believed inverse of the strong coupling constant α_s [67].

With these applications it is possible to say that, Stoney mass plays a vital role in particle physics and cosmology.

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